TR114™ ISA Analog Hardware Guide

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Brooktrout Technical Support

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Preface

About This Manual

This hardware guide describes how to install and connect Brooktrout's ISA-based TR114 analog loop-start and DID boards to the telephone service. It also explains how to test the installation.

Audience

This guide is written for those who install and configure telephony boards.

The information in the guide is intended for the United States and Canada. The *TR114 ISA Analog International Hardware Guide* is available for countries outside of North America and includes important information for those installations.

Related Documents

TR114 ISA Analog Quick Start

TR114 Firmware Installation and Release Notes

The following documents are available for developers:

Fax, Voice, and Data API V4.0, Volume 1, User's Guide

Fax, Voice, and Data API V4.0, Volume 2, Programmer's Reference

Manual Conventions

This manual uses the following conventions:

- *Italics* denote file names, directory names and program names within the general text, for example, “the *btcall.cfg* file”.
- The **`Courier`** font in **bold** indicates a command sequence entered by the user at the system prompt, for example:

  `cd /usr/sys/bfax/app.src`

- The `Courier` font not bolded indicates system output, for example:

  ```
  c:>Files installed.
  ```

- The icon below indicates a **Caution** note, meaning that the software or hardware may be damaged if the proper precautions are not observed.

Chapter 1
Introduction

The TR114 family of analog fax telephony boards consists of two-channel and four-channel models for use in computers with ISA/EISA buses. The TR114 is a powerful fax and voice product that can be used for many applications, including fax broadcast, fax-on-demand, fax store and forward, LAN fax servers, e-mail to fax services, and combined voice and fax applications.

TR114 ISA Analog Models

Brooktrout offers the following TR114 ISA analog board configurations for loop-start and DID telephone service.

Board	Description
TR114+I2L	Two loop-start channels
TR114+I2C	One loop-start channel and one DID channel
TR114+I2D	Two DID channels
TR114+I4L	Four loop-start channels
TR114+I4C	Two loop-start channel and two DID channels
TR114+I4D	Four DID channels

Features

The features of the TR114 ISA analog board provide high-performance fax and voice systems:

- Two or four independent fax and/or voice channels in one 8-bit or 16-bit ISA or EISA bus slot.
- Direct Memory Access (DMA) and Programmed I/O (PIO) data transfer capability (8-bit and 16-bit transfers) for efficient, multichannel support.

- Full Group 3 fax send-and-receive functionality on each channel, with advanced features, such as Error Correction Mode, Binary File Transfer, and MH, MR, or MMR compression.
- Speech record and playback.

  Each channel can record and play back ADPCM and PCM, permitting you to build a variety of fax and voice systems using a single TR114, such as voice prompted fax retrieval systems, fax mail systems with voice annotation capability, and integrated voice/fax mail systems.
- DTMF (Touch Tone), SIT, CNG, and CED detection capability.
- Auto conversion of ASCII, MH, MR, MMR, TIFF, and PCX/DCX files.
- Onboard forms overlay capability increases efficiency and throughput of high-volume forms-based fax applications.
- Automatic reduction or expansion of the page width on transmission.
- Adaptive in-band and out-of-band call progress detection capability that works world-wide.
- Downloadable firmware. Updates are easily installed, even in the field, from a diskette or from the Brooktrout web or FTP site.
- LED status indicators.
- Support for 11 hardware interrupts.
- FCC Part 68 and Part 15 Class A approval. Industry Canada Approval. And ETL recognition for U.S. and Canadian safety certification.
- Application Programmer's Interface tools and software drivers for a number of operating systems. See the *Brooktrout Fax, Voice, and Data Application Programming Interface User's Guide*.

System Requirements

To run a Brooktrout TR114 ISA analog board, your system requires the following:

- One 8-bit or 16-bit slot in any computer with an ISA or EISA expansion bus. (Use of the edge connector for 16-bit slots is only necessary when you use hardware interrupts 10 through 15, or 16-bit DMA channels.)

  Note: If you use an EISA slot, you may need to create an EISA configuration file for the board. Using the BIOS, reserve the interrupt, I/O addresses and DMA (if used).

- One hardware interrupt.

  All TR114 ISA series boards in the system *must* share the same interrupt.

- One DMA channel selected through software (optional).

  The TR114 ISA can transfer data to or from the host computer using Programmed I/O (PIO) or using Direct Memory Access (DMA).

  If you use DMA, all TR114 ISA series boards in the system *must* share the same DMA channel.

- A block of consecutive I/O addresses:

  - 12 addresses to support the two channel TR114 boards
  - 20 addresses to support the four channel TR114 boards

- Telephone service for loop-start TR114 telephone interface (analog single-line extension for PBX or Key telephone systems), and/or for DID TR114 telephone interface.

  Appendix B, Telephone Service Options explains how to order telephone service.

- An external -48V$_{DC}$ power supply for DID operation

  You need to purchase a power supply for the TR114. Brooktrout offers Tellabs 8012 or 8001 power supplies. The 8012 (recommended) is UL and CSA certified for use with the TR114 DID models.

Operating Requirements

- Temperature: 0° - 50° C (32° - 122° F)
- Humidity: 10% - 95% (noncondensing)
- Power requirements (±5%):

Type	+5VDC	+12VDC	-12VDC	Total Power
2-channel	1.5 A	5 mA	20 mA	7.8 W
4-channel	2.5 A	5 mA	35 mA	13 W

- Power requirements for DID operation:

Tellabs Model	Current Supplied	Current Used per Channel	DID Trunks Supported
8001	1 A	40 mA	25
8012	0.25 A	40 mA	6

Computer Platforms

Brooktrout recommends the following computer manufacturers:

Network Engines 781-961-4400
Diversified Technology, Inc. 800-443-2667
Industrial Computer Source 800-523-2320
Texas MicroSystems 713-541-8200

Required Cables

Brooktrout supplies the telephone cables with the TR114 board. If you wish to make cables for your TR114, see *Appendix C, Telephone Jack Pinout* for cabling information.

Chapter 2
Configuration and Installation

This chapter explains how to configure and install TR114 ISA analog loop-start and DID boards. It also explains how to connect the cables for loop-start and DID telephone service.

The following tasks are required to install and set up your TR114 board:

- Configure the hardware
- Install the board in a system
- Install a power supply for DID service
- Connect the cables
- Install the firmware
- Install and configure the software

Board Layout

Figure 2-1 shows the layout of a TR114 ISA loop-start board and Figure 2-2 shows the layout of a TR114 ISA DID board to illustrate the placement of user-configurable components.

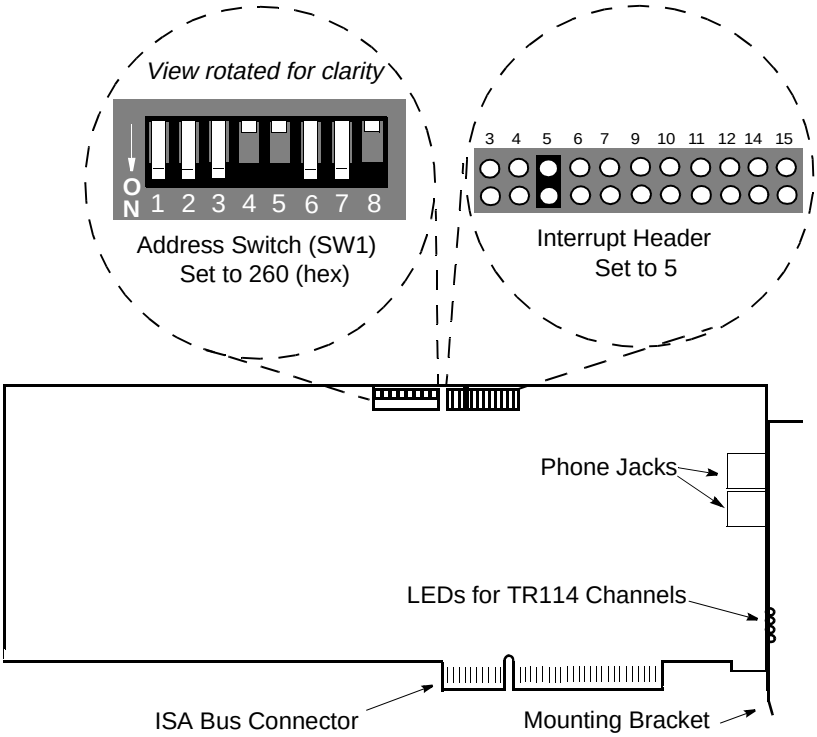

Figure 2-1. TR114 ISA Analog Loop-Start Board Layout

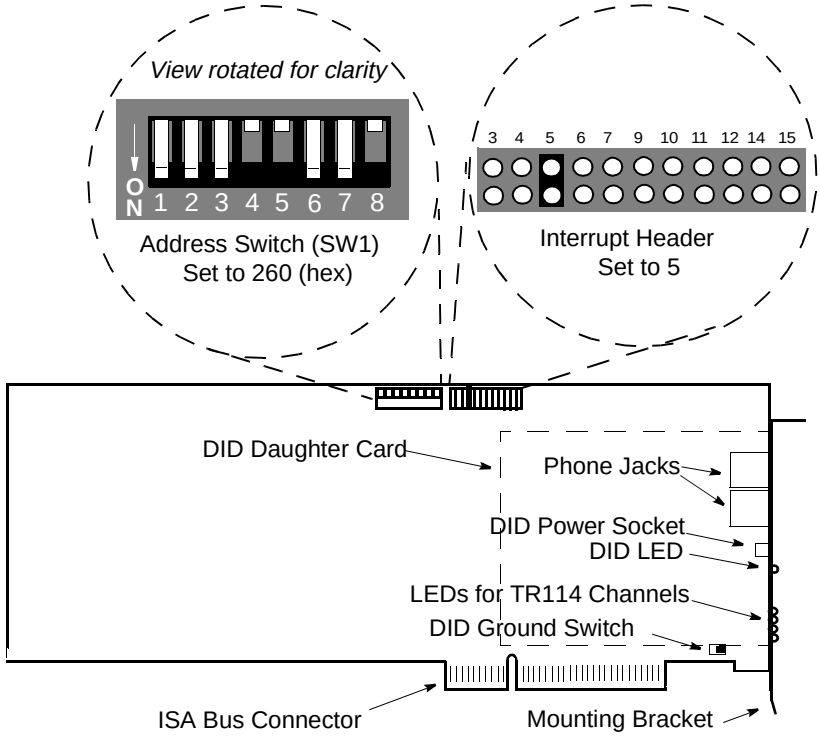

Figure 2-2. TR114 ISA Analog DID Board Layout

DID Power Supply Socket

For DID boards, the socket for connecting the DID power supply is located on the mounting bracket below the RJ-45 jacks, see Figure 2-3.

Ground Switch

A ground switch on the DID daughter board is set to grounded (toward the bracket) by default. If you have problems with noise on the DID lines, Brooktrout Technical Support may tell you to reset this switch. Do not change the switch unless Brooktrout instructs you to do so.

Mounting Brackets

Figure 2-3 shows the mounting bracket for the TR114 ISA analog DID boards. The loop-start board brackets look the same except they do not have the DID power socket and the DID LED.

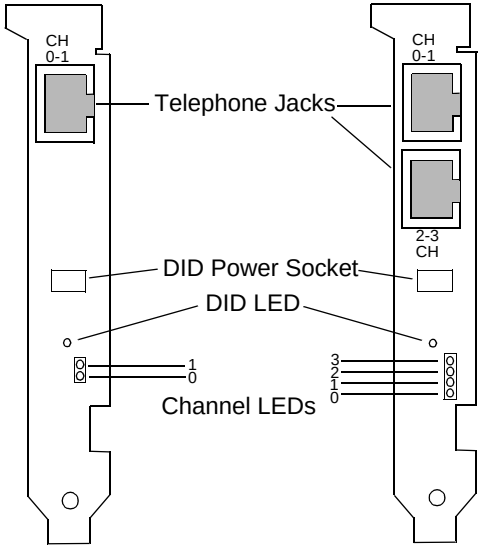

Figure 2-3. TR114 Mounting Brackets

LED Activity

The LEDs can be useful for troubleshooting problems.

The red LEDs indicate the activity of their associated TR114 channels. The LEDs will:

- Flash once at computer power up.
- Flash periodically after TR114 firmware is downloaded.
- Flash more rapidly when the channel goes off hook.
- Flash when the channel is receiving data from the host.

The green LED indicates the status of DID power. The LED will be on when the power supply is supplying power to the board.

Configuring the TR114 Hardware

To configure the TR114 ISA analog board, you must set a base I/O address and interrupt on the board. You can accept the defaults or make changes as needed; this is explained in the following sections.

Using the Default Configuration

You can set up the board quickly by accepting the default settings:

I/O base address = 260 hex
Hardware interrupt = 5
Data transfer mode = DMA 1 or PIO (set in software)

You may need to change the default settings if your system has other TR Series boards installed or the TR114 has a conflict with another device or software. The following sections explain how to make changes to these settings.

Changing the Hardware Configuration

The following sections explain how to change the base I/O address and the hardware interrupt setting for TR114 ISA analog boards. If you have a conflict with another device, see *Appendix A, Common System Resource Assignments,* for address, interrupt, and DMA channel settings that systems commonly assign to devices.

If you change the settings on the board, we recommend you keep a record of these values; they will need to be set in the software.

Setting the Hardware Interrupt

The TR114 ISA analog board is shipped with the interrupt set to 5. The interrupt numbers are etched on the board at the top of the interrupt header.

A TR114 ISA board can use the following interrupts:

- For 8-bit slots; 3, 4, 5, 6, 7, or 9
- For 16-bit slots; all available interrupts.

In order of preference, we recommend using interrupt 5, 7, or 3 for 8-bit slots, and interrupt 12, 5, 10, or 15 for 16-bit slots.

All TR114 ISA boards installed in the same system *must* share the same interrupt.

To set the hardware interrupt, place the jumper plug on the pair of pins that corresponds to the interrupt you want to use. Refer to Figure 2-2 for the location of the interrupt header on the board.

Setting the Base Address

Each two-channel TR114 board requires a block of 12 consecutive I/O addresses; each four-channel TR114 board requires a block of 20 consecutive I/O addresses. These I/O addresses must not overlap with those of any other TR114 or other device installed in the system. The base address, a three-digit hex number, is the first address in the assigned block.

To enable communication between the TR114 and the host, and to provide access to each channel, the block of addresses is subdivided into a number of smaller blocks, each of which consists of four addresses. Each channel uses one of these smaller blocks, and the TR114 reserves one block for communication with the host.

For example, when the base address is set to 260 (hex), a four-channel TR114 ISA board uses the following addresses to communicate with the host and with channels 0 through 3:

Addresses	Communicate with:
260-263	TR114 Host Interface
264-267	TR114 Channel 0
268-26B	TR114 Channel 1
26C-26F	TR114 Channel 2
270-273	TR114 Channel 3

A two-channel TR114 ISA board would use the addresses assigned for communication with the host and with channels 0 and 1.

Use switch SW1 to set the I/O base address for the TR114 (see Figure 2-2 for the location of the switches on switch SW1). The default setting is 260 (hex). On SW1, switches 2 through 8 set the individual digits in the TR114 base address.

- Switches 8 and 7 set the first, or most significant digit (2xx)
- Switches 6, 5, 4, and 3 set the middle digit (x6x)
- Switch 2 sets the third, or least significant digit (xx0)
- Switch 1 enables an interrupt pull-up; it does not affect the base address. It must be ON on *only* one TR114 in the system

Recommended Base Addresses

To change the base address on your TR114 ISA board, use one of the addresses shown in Table 2-1. If you are unable to use an address shown in this table, refer to Table 2-2 for more addresses.

Note that the tables list the settings in order from switch 8 to switch 2, from the high order digits to the low order digits.

Table 2-1. Recommended Base Addresses

Base I/O Address	8	7	6	5	4	3	2	
100	ON	OFF	ON	ON	ON	ON	ON	
140	ON	OFF	ON	OFF	ON	ON	ON	
180	ON	OFF	OFF	ON	ON	ON	ON	
200	OFF	ON	ON	ON	ON	ON	ON	
220	OFF	ON	ON	ON	OFF	ON	ON	
240	OFF	ON	ON	OFF	ON	ON	ON	
260	OFF	ON	ON	OFF	OFF	ON	ON	Default address
280	OFF	ON	OFF	ON	ON	ON	ON	
2A0	OFF	ON	OFF	ON	OFF	ON	ON	
2C0	OFF	ON	OFF	OFF	ON	ON	ON	

Using Other Base Addresses

You can select a base address from settings between 100 and 3F8. Table 2-2 shows how to set the switches on switch SW1 to select base addresses ranging between 100 to 3F8.

Table 2-2. Base Addresses between 100 to 3F8

Base I/O Address	8	7	6	5	4	3	2
1xx	ON	OFF					
2xx	OFF	ON					
3xx	OFF	OFF					
x0x			ON	ON	ON	ON	
x1x			ON	ON	ON	OFF	
x2x			ON	ON	OFF	ON	
x3x			ON	ON	OFF	OFF	
x4x			ON	OFF	ON	ON	
x5x			ON	OFF	ON	OFF	
x6x			ON	OFF	OFF	ON	
x7x			ON	OFF	OFF	OFF	
x8x			OFF	ON	ON	ON	
x9x			OFF	ON	ON	OFF	
xAx			OFF	ON	OFF	ON	
xBx			OFF	ON	OFF	OFF	
xCx			OFF	OFF	ON	ON	
xDx			OFF	OFF	ON	OFF	
xEx			OFF	OFF	OFF	ON	
xFx			OFF	OFF	OFF	OFF	
xx0							ON
xx8							OFF

Ensuring a Unique Base Address When Using Multiple TR114s

To ensure a unique base address for each TR114 board when you install multiple TR114 boards in a system, for each additional TR114, add or subtract the value below from the base address of the previous TR114:

- 10 (hex) for two-channel boards
- 18 (hex) for four-channel boards

For example, three possible address configurations are shown below that represent three 4-channel TR114 ISA boards installed in a system.

	Board 1 Base Address	Board 2 Base Address	Board 3 Base Address
Example 1:	228	240	258
Example 2:	250	268	280
Example 3:	260	278	290

Avoiding Conflicts with PCI or Plug and Play Boards

This section describes how to avoid conflicts with other types of boards. Refer to *Appendix A, Common System Resource Assignments* for details on the particular addresses and interrupts that other boards, hardware devices, and software commonly use.

Using ISA Boards with Plug and Play Boards

The PC BIOS automatically configures the addresses and hardware interrupts (IRQs) for PCI and plug and play boards, which may change when the system is rebooted, especially if devices are added or moved. The BIOS does not automatically recognize the ISA boards in your system when configuring with PCI and plug and play boards. Interrupts can be shared among PCI boards, but not between PCI boards and ISA boards.

The action you take to avoid conflicts among the various boards depends on your brand of computer. Check the manufacturer's instructions for techniques to avoid conflicts.

Generally, you can avoid conflicts among ISA, PCI, and plug and play boards by doing the following:

- Let the PC BIOS configure all PCI and plug and play boards.
- Use the tools supplied with the PC to determine the interrupts used or reserved by other devices in your PC. For example, Dell computers have an ISA Configuration Utility to track and reserve the installed ISA boards and the resources they use.
- Choose a free interrupt and address for the TR114 boards. All TR114 boards must share an IRQ setting.

Using ISA Boards in EISA Slots

If you install ISA boards in EISA slots, use an EISA configuration utility to create an EISA configuration file to reserve the interrupt, I/O addresses, and DMA (if used) for the TR114 ISA board. The PC BIOS then will not use the reserved interrupt, addresses, and DMA for other devices in your computer. Brooktrout does *not* supply EISA configuration files for the TR114 board. Check the PC manufacturer's documentation for instructions on creating an EISA configuration file.

If you are installing multiple TR114 boards in EISA slots, create an EISA configuration file for each slot and specify the unique base I/O address of each board in its respective slot. However, you must enter the interrupt for only one of the TR114 slot configurations even though multiple TR114 ISA boards share the same interrupt. This is because EISA configuration utilities do not allow an interrupt to be entered more than once.

If you cannot find a free interrupt, you may be able to disable an LPT port or a COM port that is not being used. These ports can be disabled in the BIOS on some computers. On older computers, it may require a change to a jumper setting on the motherboard. Once the port is disabled, its associated interrupt becomes available. The typical interrupt associated with a particular port is:

LPT – IRQ 7
COM1 – IRQ 3
COM2 – IRQ 4

Installing the TR114 ISA Board in the Computer

Once the TR114 ISA analog board is configured with the proper base address and hardware interrupt, you can install it in your computer. Follow the instructions provided by the manufacturer of your computer for installing adapter boards.

The TR114 ISA board is an electrostatic-sensitive device. Follow proper ESD procedures when handling the board.

If you are connecting a loop-start board, connect to the loop-start service as described below.

If you are connecting to DID service, go to the section, *Installing a Power Supply for DID Service* on the next page and follow those instructions.

Connecting to Loop-Start Telephone Service

To connect the TR114 to the telephone service, plug one end of the provided telephone cable into the telephone jack on the TR114 board and plug the other end of the cable into a wall-mounted telephone jack (see Figure 2-4).

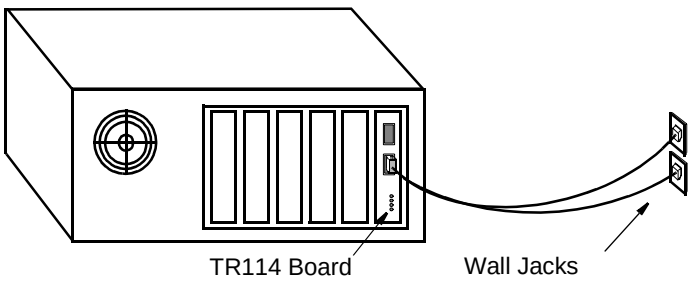

Figure 2-4. Connecting TR114 Cables to Telephone Service

For more information on loop-start service, see the section, *Loop-Start Telephone Service* on page B-1.

Installing a Power Supply for DID Service

The TR114 DID channel must supply the DID trunk line with continuous -48V$_{DC}$ power. Service can be lost if the telephone company does not detect -48V$_{DC}$ power on the line. A Tellabs 8012 or 8001 (or equivalent) regulated power pack supplies the necessary -48V$_{DC}$ power.

After you install the TR114 DID (or combination loop-start and DID) board in the computer, but *before* you connect the telephone lines for DID service, connect a power supply to the TR114.

You can connect multiple TR114 DID boards to a single Tellabs power supply. However, Brooktrout recommends that each board have its own power supply so that power is not lost for multiple boards if a single power supply fails.

Once the DID power supply is installed, leave it on to ensure continued DID service. You can turn off the computer without turning off the DID power supply.

After following the instructions for connecting a Tellabs 8012 power supply below or a Tellabs 8001 power supply (page 2-15), continue with the installation instructions in the section, *Connecting to DID Telephone Service* on page 2-17.

Connecting a Tellabs 8012 Power Supply

You can connect up to six (6) TR114 boards to a single Tellabs 8012 power supply by connecting their DID power cords to the same contacts. Connect the 8012 as follows:

1. If the power supply is plugged into a wall socket, unplug it.
2. Power off the computer.
3. An 8012 power supply from Brooktrout comes with a ground wire connected to the contacts labeled 48V RET and FRM GRD (Figure 2-5). Verify the ground wire is connected to the contacts.

If your Tellabs 8012 is supplied by another vendor, you may have to provide your own ground wire.

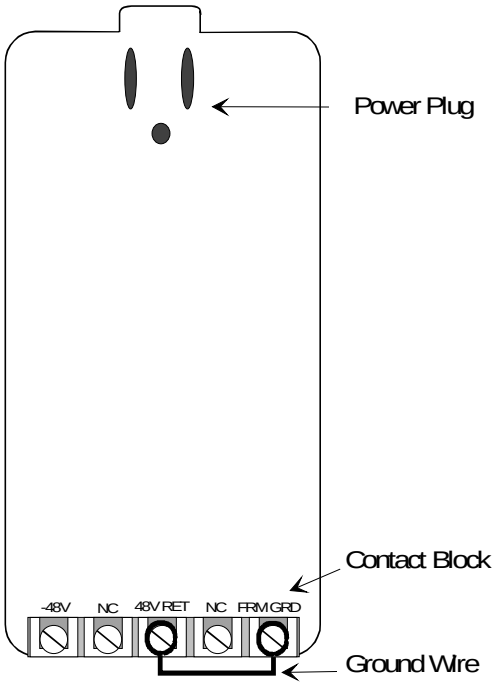

Figure 2-5. Tellabs 8012 Power Supply, Rear View

4. Locate the DID power cord supplied with the TR114 (Figure 2-6).

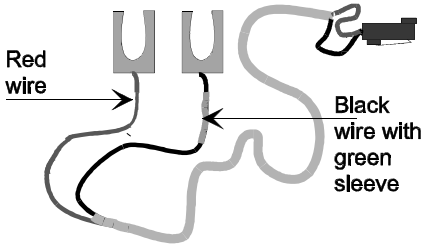

Figure 2-6. DID Power Cord

The DID power cord has a plastic plug on one end, and two metal connectors on the opposite end. The split end of the DID power cord consists of one red wire and one black wire with a green sleeve.

5. Connect the DID power cord as follows (see Figure 2-7):

   a. Connect the metal connector on the end of the black wire with the green sleeve to the 48V RET contact (on the same contact with the ground wire) and tighten the contact screw.

   b. Connect the metal connector on the end of the red wire to the -48V contact and tighten the contact screw.

   c. If you are connecting multiple TR114s to the power supply, connect each DID power cord using steps *a* and *b*.

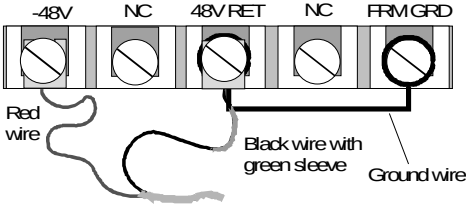

Figure 2-7. DID Power Cord Connected to 8012 Power Supply

6. Plug the other end of the DID power cord(s) into the power supply socket located on the TR114 mounting bracket.
7. Power up the computer.
8. Plug the power supply into a grounded wall socket.

CAUTION

The wall socket *must* be grounded to protect the power supply and board.

Continue with the installation instructions in the section, *Connecting to DID Telephone Service* on page 2-17.

Connecting a Tellabs 8001 Power Supply

You can connect up to 25 TR114 boards to a single Tellabs 8001 by connecting their DID power cords to the same contacts on the power supply. Connect the 8001 as follows:

1. If the power supply is plugged into a wall socket, unplug it.
2. Power off the computer.
3. On the back of the power supply, make sure the three-position power selection switch is set to Off (Figure 2-8).
4. On the contact block on the back of the power supply (Figure 2-8), make sure the metal plate is connecting the two contacts labeled "+" and "COM". If it is not, use a screwdriver to loosen the contacts and move the metal plate so "+" and "COM" are connected. Do not tighten the "+" or "–" contact screws yet.

   Make sure the contact labeled "–" is not connected to another contact.

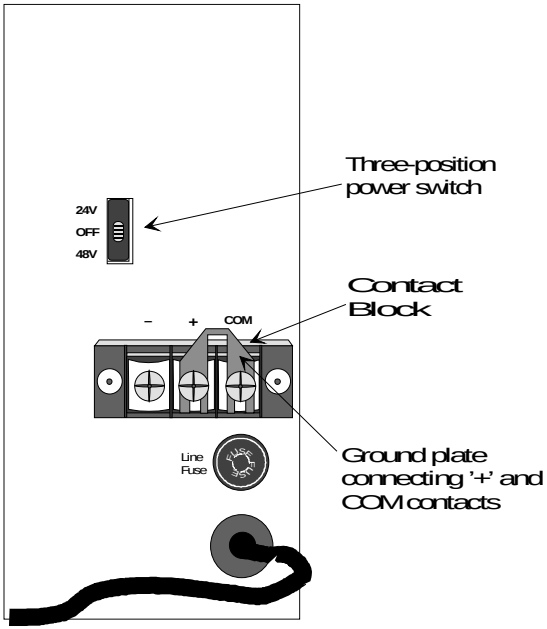

Figure 2-8. Tellabs 8001 Power Supply, Rear View

5. Locate the DID power cord supplied with the TR114 DID board (see Figure 2-6).

   The DID power cord has a plastic plug on one end, and two metal connectors on the opposite ends. The split end of the DID power cord consists of one red wire and one black wire with a green sleeve.

6. Connect the DID power cord as follows:

   a. Connect the black wire with the green sleeve to the "+" contact and tighten the contact screw (Figure 2-9).

   b. Connect the red wire to the "–" contact and tighten the contact screw (Figure 2-9).

   c. If you are connecting multiple TR114s to the power supply, connect each DID power cord using steps *a* and *b*.

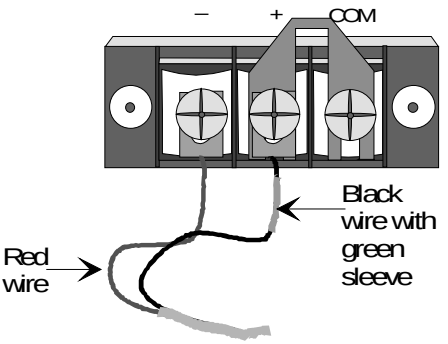

Figure 2-9. DID Power Cord Connected to Power Supply

7. Plug the other end of the DID power cord(s) into the power supply socket located on the TR114 mounting bracket.
8. Power up the computer.
9. Plug the Tellabs 8001 power cord into a grounded wall socket.

CAUTION

The wall socket *must* be grounded to protect the power supply and board.

10. Turn on the power supply by setting the power selection switch to 48V (Figure 2-10).

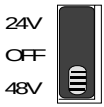

Figure 2-10.Power Selection Switch Set to 48V

Connecting to DID Telephone Service

After you have installed the TR114 DID board in the computer and connected a DID power supply to the board, you can connect the TR114 to DID telephone service. If you need more information about DID service and how to order it, see *Appendix B, Telephone Service Options*.

The following table shows how the TR114 channels connect to DID telephone service.

TR114 Model	Channel Number	Splitter Cable Label	Service Type
I2D	0 1	A B	DID DID
I4D	0 (upper jack) 1 (upper jack)	A B	DID DID
	2 (lower jack) 3 (lower jack)	A B	DID DID
I2C	0 1	A B	Loop-start DID
I4C	0 (upper jack) 1 (upper jack)	A B	Loop-start Loop-start
	2 (lower jack) 3 (lower jack)	A B	DID DID

Connect your TR114 telephone cables using the following procedure:

1. Locate the splitter cables supplied with your TR114. The provided two-split cables are labeled A and B.

   Note: If you make your own splitter cable, to ensure a stable connection, use an RJ-45 plug on the end that plugs into the RJ-45 telephone jack on the TR114.

2. Plug the end with a single RJ-45 plug into the RJ-45 jack on the TR114 mounting bracket; plug the RJ-11 plugs at the other end into wall-mounted DID phone jacks.

Do not plug a DID cable into a loop-start line – this can cause serious damage to the TR114.

The TR114 DID channels are now connected to the DID lines.

Installing the Firmware

The TR114 firmware is included on a single DOS formatted diskette. Before you run any applications that use the TR114, see the *TR114 Firmware Installation and Release Notes* for detailed instructions on how to copy the contents of the diskette onto your hard drive and how to download the firmware to the TR114.

If you use the TR114 with LAN fax server applications, refer to the documentation accompanying the application software. In most cases, the firmware will already be included with the software you received from the LAN fax software vendor and no further installation is required.

Configuring the Software

After your board is installed, you may need to make changes to the software configuration. If you changed the I/O base address or the interrupt on the board, you need to also change them in the software.

Selecting the Host Data Transfer Method

The TR114 ISA analog board can transfer data to and from the host computer in Programmed I/O (PIO) mode or in Direct Memory Access (DMA) mode. You set the method in the software during driver installation.

Under PIO, the host computer CPU controls data transfers between memory and the TR114 channels. Although transfer time is faster, the host computer cannot process other jobs during the transfer.

Under DMA, the DMA driver controls data transfers between memory and the TR114 channels. Although using DMA may take a little longer than PIO, using DMA may increase system performance because the host computer can process other jobs during the transfer.

Using DMA

All TR114 ISA boards in your system must share the same DMA channel. The default DMA channel is 1.

For 8-bit slots, you can use DMA channels 0 through 3. For 16-bit slots, you can use DMA channels 0 through 3 and 5 through 7. (The system reserves DMA channel 4 for its own use). In order of preference, we recommend using DMA channel 7 (16-bit) or 1 (8-bit).

You set the data transfer method using the `dma` keyword in the default user-defined configuration file, *btcall.cfg* (see Appendix C of the Brooktrout *Fax, Voice, and Data API Programmer's Reference Manual*). You can select another option through the driver software when you install the driver. If you use a driver from another vendor, see that vendor's manual for instructions on installing the driver and selecting a DMA channel.

In addition to the TR114, other boards, devices, and software use particular DMA channels. *Appendix A, Common System Resource Assignments*, lists some of the functions that systems may assign to particular DMA channels.

To avoid conflicts with other devices, select an unused DMA channel or disable or move any device that competes for the DMA channel you select. See the manual that came with your computer for instructions on disabling a conflicting device.

Using PIO

To use Programmed I/O, change the `dma` keyword to `0` in the user-defined configuration file (see Appendix C of the Brooktrout *Fax, Voice, and Data API Programmer's Reference Manual*). You can disable the use of DMA by selecting -1 for the DMA option during Brooktrout driver installation.

Testing Your Installation

When you have installed your board and connected the cables to the telephone service, we strongly recommend that you test your setup using the Brooktrout test program. See *Chapter 3, Testing and Troubleshooting*.

Chapter 3
Testing and Troubleshooting

This chapter explains how to test your TR114 installation using Brooktrout's configuration and diagnostic software. The test software is included with your board on the DOS diskette labelled "TR Series Hardware Test." You can also download a copy of the test program from the Brooktrout web site; see *Chapter 4, Contacting Technical Support* for the procedures.

Users of LAN fax software may test the board using test software from your LAN fax vendor instead of using the TR Series DOS diagnostic program. See your vendor's manual for instructions on testing the board.

Using the Test Software

In order to test the TR114, the board must be installed in the computer and connected to active telephone service. The following tasks are required to install the test software and test your system:

- Load the test software.
- Change the TR114 configuration, if necessary.

  If you installed more than one TR114 board, you must change the configuration file before you run the diagnostics.
- Set the country code in the *user.cfg* file, if necessary.
- Boot the system under DOS.
- Test the configuration.
- Test each channel by sending and receiving a fax.
- Reboot your system under your preferred operating system.

The tasks are explained in the following sections.

TR114 Test Files

Table 3-1 describes the files included in the diagnostic software. The test files must remain together; do not store them in separate directories.

Table 3-1. TR114 Test Files

File Name	Description
btdriver.bat, btk1.exe, btk2.exe	A batch file and DOS TSR that must be installed to run the *faxtest* program.
btdriver.cnf	The configuration file that contains the interrupt, the DMA channel, and the I/O addresses of the TR114 channels in your system. Used by the *btdriver.bat* file.
country.cfg	Read-only configuration file with country-specific information.
faxtest.exe	A test program you can use to send and receive facsimiles.
send.fil	A single page Group 3 fax test file; sent by default.
test-164.pex	Test firmware automatically downloaded by the *faxtest* program to the TR114.
user.cfg	A user-modifiable configuration file that contains a number of run-time configuration parameters.

Installing the Test Software

You can copy the contents of the test diskette to your hard drive or you can run the program from the diskette.

Note: If you are using OS/2, Windows NT, or Unix, do not use the test program from a DOS window. Boot from a DOS diskette and run the test software from the disk drive.

1. Make the directory in which to store the test software (for example, *bfax\faxtest)* by typing:

   ```
   mkdir \bfax\faxtest
   ```

2. Make the new directory the current directory:

   ```
   cd \bfax\faxtest
   ```

3. Copy the files from the diskette to the current directory:

   ```
   copy A:*.*
   ```

4. For Windows and DOS systems: If there are other software applications or TSRs for Brooktrout boards running on your system, create a temporary *autoexec.bat* file that does not contain the lines that run such software.

5. For Windows and DOS systems: Reboot your system using the modified *autoexec.bat* file.

   Remember to restore the original *autoexec.bat* file when you finish testing.

Changing the TR114 Configuration

Depending on the number and models of TR114 boards you installed and whether their installation caused any conflicts with other hardware or software in your system, you may need to edit the *btdriver.cnf* configuration file distributed with the test software. You can use your system's text editor or any ASCII text editor to change the parameters in this file.

The *btdriver.cnf* configuration file contains the following configuration parameter values:

```
intnum 5
dmachan 1
addrs 264 4
```

The configuration parameters shown above indicate that a four-channel TR114 is installed at base address 260 and is using interrupt 5 and DMA channel 1. This is the default configuration.

For each additional TR114, add another `addrs` line in the configuration file. For example, if you installed two TR114 four-channel boards in your system (one at address 260 and the other at address 280), you would change the contents of the *btdriver.cnf* configuration file as follows:

```
intnum 5
dmachan 1
addrs 264 4
addrs 284 4
```

If you installed one TR114 two-channel board in your system (at address 260), you would change the contents of the configuration file as follows:

```
intnum 5
dmachan 1
addrs 264 2
```

Testing the Configuration

Test the TR114 configuration using the following procedure.

1. Boot up your system to run under DOS (if it is not already).
2. Change to the directory in which you copied the test software.
3. Execute the *btdriver* batch file:

   `btdriver btdriver.cnf`

4. Verify that the program displays the same number of channels you installed in your system and specified in the *btdriver.cnf* file.

   For example, if you have one TR114 four-channel board installed in your system, you should see the following output:

   ```
   Total Channels: 4 TR114; 0 Trufax;
   0 TR112/TR111MC; 0 TR200
   No BRI TR114s found
   ```

   If you have two TR114 four-channel boards installed in your system, you should see the following output:

   ```
   Total Channels: 8 TR114; 0 Trufax;
   0 TR112/TR111MC; 0 TR200
   No BRI TR114s found
   ```

5. If the number of channels is correct, the system initialized successfully. If it is not correct, refer to the following checklist for possible solutions.

   a. Make sure the switches on the address switch (SW1) and the interrupt jumper are set correctly on the board, and that they match the parameters in the *btdriver.cnf* configuration file.

b. Make sure the I/O address settings do not conflict with another device in your system. Refer to *Appendix A, Common System Resource Assignments* for more information.

c. If you are installing multiple TR114s, make sure that each board had a unique base I/O address and that it is entered in the *btdriver.cnf* configuration file.

d. If you install the board in an EISA slot, make sure you create an EISA configuration file through the BIOS.

e. Make sure the LEDs (on the TR114 mounting bracket) flash once when you power up the system. If they fail to flash, or if they remain on, there may be a problem with the TR114 or with the computer. To determine where the problem lies, try the following:

    1. Install the TR114 in another slot and power up the system again.
    2. If the LEDs still fail to flash correctly, install the TR114 in another computer if possible, and try again.
    3. If the LEDs still fail to flash correctly, contact Brooktrout Technical Support or the reseller from whom you purchased your TR114 board. See *Chapter 4, Contacting Technical Support* for information.

Identifying Channel Connections

The telephone cables for your model TR114 should be connected as shown in the following table

TR114 Model	Channel Number	Splitter Cable Label	Service Type
I2L	0 1	A B	Loop-start Loop-start
I4L	0 (upper jack) 1 (upper jack)	A B	Loop-start Loop-start
	2 (lower jack) 3 (lower jack)	A B	Loop-start Loop-start
I2D	0 1	A B	DID DID
I4D	0 (upper jack) 1 (upper jack)	A B	DID DID
	2 (lower jack) 3 (lower jack)	A B	DID DID
I2C	0 1	A B	Loop-start DID
I4C	0 (upper jack) 1 (upper jack)	A B	Loop-start Loop-start
	2 (lower jack) 3 (lower jack)	A B	DID DID

Channel Assignments When Using Multiple TR114s

When you are using multiple TR114s, the *btdriver* program assigns channel numbers sequentially (0, 1, 2, 3, 4, 5, . . .), starting with the first channel on the TR114 that occupies the lowest base I/O address and ending with the last channel on the TR114 that occupies the highest base I/O address.

Testing Loop-Start Channels

This section explains how to send and receive test faxes on TR114 loop-start channels. To test DID channels, refer to *Testing DID Channels* on page 3-9.

Before you run these tests, *btdriver* must have loaded successfully and the TR114 cables must be connected to the loop-start telephone lines. To perform these tests, you need access to a fax machine.

You can display the list of command line options available for *faxtest* by typing:

```
faxtest
```

Sending a Test Fax

Run this test for each loop-start channel in your system, typing in the appropriate channel number each time. The test file, *send.fil*, is automatically sent with each test.

1. Change to the directory in which you copied the test software (in this example, *\bfax\faxtest*) by typing:

   ```
   cd \bfax\faxtest
   ```

2. Execute the *faxtest* program by typing:

   ```
   faxtest -u <#> -s w<phonenum>
   ```

   where:

   -u <*#*> Specifies the number of the channel that you want to test, for example, **`-u 0`** specifies channel 0.

   `-s` Places the channel in send mode.

   w Forces the TR114 to wait for a dial tone.

   We strongly recommend inserting **`w`** before any digits in the dial string. If you install the TR114 on a PBX extension, you may have to insert **`w9w`** in front of the fax machine's phone number, for example, **`faxtest -u 0 -s w9w5551212`**.

   Inserting **p** before the first digit in the dial string causes the board to pulse dial; otherwise, it uses touch tones to dial.

   <*phonenum*> The phone number of the fax machine that will receive the fax.

3. If the fax transmission is successful, the following message is displayed at the end of the test:

   ```
   Fax Sent Successfully - Test Completed.
   ```

   Otherwise, an error message is displayed. Refer to *Board Installation/Test Conditions* on page 3-12 for information on solving problems.

Receiving a Test Fax

Run this test for each loop-start channel, typing in the appropriate channel number each time.

1. Change to the directory in which you copied the test software (in this example, *\bfax\faxtest*) by typing:

   `cd \bfax\faxtest`

2. Execute the *faxtest* program by typing:

   `faxtest -u` *<#>* **`-r`**

   where:

   `-u <#>` Specifies the number of the channel that you want to test, for example, **`-u 0`** specifies channel 0.

   `-r` Places the channel in receive mode.

   The program displays the following message when it is ready to receive a fax:

   ```
   waiting for a call
   ```

   If this message fails to display, refer to *Board Installation/Test Conditions* on page 3-12 for more information.

3. From a fax machine, dial the telephone number connected to the channel you are testing to send it a test fax.

4. If the fax is received successfully, the *faxtest* program displays the following message:

   ```
   Fax received successfully - Test Completed
   ```

   Otherwise, it displays an error message. Refer to *Board Installation/Test Conditions* on page 3-12 for information on solving problems.

Testing DID Channels

This section explains how to test DID channels with and without active DID service:

- Testing without active DID service (with a telephone connected directly to the DID channel) ensures that the hardware and power supply are functioning properly.
- Testing with DID service ensures that the TR114 DID parameters are configured correctly in the *btdriver.cfg* file and that the TR114 is providing the proper voltage to the telco and generating the wink signal.

To perform the tests, you need access to a fax machine with an attached telephone or to a standard analog telephone.

Before you run either test, the *btdriver* program must have loaded successfully and a -48 VDC power source must be connected to the board. Before you can run the test with active DID service, you must also activate the DID line, connect the DID channels on the TR114 to the telephone lines, and make sure the DID-related parameters in the *user.cfg* file match the DID service options.

Changing the DID Configuration File

The *user.cfg* file is a text file that contains two DID-related parameters, `service_type` and `did_digits`, that you may need to change depending on your DID service. The default value for `service_type` is `wink` and the default for `did_digits` is `4`.

If your DID service is set up for immediate-start operation, change the `service_type` value to `immediate`. Depending on your DID service, you may also need to change the number of DID digits.

Use any ASCII text editor to change these values in the *user.cfg* configuration file.

Testing DID Channels without Active Service

This section explains how to test reception on a DID channel without active service connected directly to the DID channel. To run this test, you need a standard analog telephone or a fax machine with a built-in telephone.

Run this test for each DID channel.

1. Connect a telephone directly into a DID channel of the TR114. Use the split cable supplied with the TR114 (see the *Identifying Channel Connections* on page 3-6 for identifying TR114 DID channels).
2. Change to the directory in which you copied the test software (in this example, *\bfax\faxtest*) by typing:

   ```
   cd \bfax\faxtest
   ```

3. Execute the *faxtest* program:

   ```
   faxtest -u <#> -r
   ```

   where:

   `-u <#>` Specifies the number of the channel that you want to test, for example, **`-u 0`** specifies channel 0.

   `-r` Places the channel in receive mode.

   The program displays the following message when it is ready to receive a call:

   ```
   waiting for a call
   ```

   If this message fails to display, refer to the *Board Installation/Test Conditions* on page 3-12 for more information.

4. Pick up the handset and dial the appropriate number of DID digits from the fax machine/telephone connected to the DID channel you are testing.

   If the DID digits are detected successfully, the digits are displayed on the screen, and the TR114 generates a fax answer tone.

   If the DID digits do not display or if there is no fax answer tone, run the *faxtest* program again and see if you can hear the DID digits in the telephone receiver as you enter them.

a. If you can hear the digits, check the setup of the *user.cfg* configuration file:

   - If the DID parameter values are incorrect, change them.
   - If the DID parameter values are correct, run the *faxtest* program again, and make sure it's really waiting for a call.

b. If you cannot hear the digits, the line is not receiving voltage.

   Check the power supply, the power connection, and the cable to the TR114.

Testing DID Channels with Active Service

This section explains how to test call reception on any DID channel with active DID service.

1. Connect the DID channel to the DID telephone line. Use the splitter cable supplied with the TR114.
2. Change to the directory in which you copied the test software (in this example, *\bfax\faxtest*) by typing:

   ```
   cd \bfax\faxtest
   ```

3. Execute the *faxtest* program by typing:

   ```
   faxtest -u <#> -r
   ```

   where:

   `-u <#>` Specifies the number of the channel that you want to test, for example, **`-u 0`** specifies channel 0.

   `-r` Places the channel in receive mode.

   The program displays the following message:

   ```
   waiting for a call
   ```

   If this message fails to display, refer to *Board Installation/Test Conditions* on page 3-12 for information on solving problems.

4. Make a call to your DID channel and check to see if you hear fax tones. If so, the line is fine.

If instead, you hear a fast busy signal right away, the telephone company may not have yet activated the line. Check with the telephone company; if they tell you that the line is activated, check *Board Installation/Test Conditions* on page 3-12 for more information.

Troubleshooting

This section provides troubleshooting suggestions for board test and installation conditions, and also for DID and *btdriver* test problems.

Board Installation/Test Conditions

You may encounter some of the error conditions described in this section when you run the test program on TR114 ISA analog boards.

SYMPTOM(S): *faxtest* displays the message `no dial tone`

Probable Cause: Cables are not connected correctly.

Solution: Make sure that telephone service has been activated on the line.

Make sure that your loop-start cable is connected to a loop-start phone line

Make sure your DID cable is connected to a DID phone line.

SYMPTOM(S): *faxtest* displays the message `Reorder Busy.`

Probable Cause: On outdialing, the TR114 always reports that the line is busy.

Solution: The system is dialing prematurely. Insert a dialing prefix `ww` or `w,` at the beginning of each dial string.

Check your PBX to ensure that calls are routed correctly. You may have to dial 8 or 9 to dial outside.

SYMPTOM(S): Cannot send and/or receive faxes properly. The fax can be received but is unrecognizable; or

faxtest reports `reset failed`

Probable Cause: DMA conflict or mismatch, or a DMA incompatibility exists with the computer's motherboard.

Solution: To confirm that it is a DMA issue, change the `dma` parameter from `dma 512` to `dma 0` or `-512` in the *user.cfg* file.

Or change `dmachan` to `-1` in *btdriver.cnf* and reinstall the driver by typing:

```
btdriver -k
btdriver btdriver.cfg
```

Use operating system tools (such as NT Diagnostics), system documentation, or BIOS configuration, to check for device conflicts and DMA entries.

Try other DMA settings, even if the DMA chosen is expected to be free.

Check the BIOS configuration if one is available for your system. Many EISA systems will not allow the DMA to be used unless it is configured in the BIOS.

SYMPTOM(S): *faxtest* displays the message `Originate_call: Final Call Progress: Probable human detected`.

Probable Cause: A human voice was probably detected instead of a fax tone.

Solution: Check the telephone number and have the board dial the correct fax number.

SYMPTOM(S): *faxtest* displays the message `timeout period Probable incorrect interrupt setting`.

Probable Cause: An interrupt misconfiguration or conflict occurred.

The interrupt pull-up was set incorrectly.

Solution: Try another IRQ setting; ensure that the jumper is installed properly and matches the `intnum` parameter in the *btdriver.cnf* file

Set the interrupt pull-up (switch 1 of the base address switches) on one of the TR114 boards.

Create an EISA configuration file if you installed the board in an EISA slot.

DID Conditions

The following conditions may be caused by DID problems.

SYMPTOM(S): Noise on a DID trunk when you make a call to it.

Probable Cause: Grounding problem.

Solution: Remove the ground jumper on the DID power supply contact block (see Figure 2-5 or Figure 2-7).

Remove the TR114 from the computer and move the ground switch on the daughter board to position 2 (away from the mounting bracket end of the board). See Figure 2-2.

Contact Brooktrout Technical Support. See *Chapter 4, Contacting Technical Support*.

SYMPTOM(S): DID line does not work, or there is a fast-busy signal.

Probable Causes: DID service may not be activated; or

The number of DID digits may not be set correctly in the *user.cfg* file; or

There is a polarity problem because the telephone wiring may be reversed. That is, although the output of the TR114 has the correct polarity across the telephone line's two wires (tip and ring), a wiring reversal could exist elsewhere in the building.

Solution: Verify that the number of DID digits is set correctly in the *user.cfg* file.

Make sure that DID service is active by testing the line using the procedures in *Testing DID Channels with Active Service* on page 3-11.

If the telephone test works, but you still have problems with your DID line, make sure the telephone wiring is not reversed.

SYMPTOM(S): DID line was working but now it stops working.

Probable Cause: Power from the DID power supply has been interrupted; or

Service may have been discontinued by the telco.

Solution: Make sure the DID line is connected to the TR114 and that the board is receiving -48V$_{DC}$ power from the DID power supply.

Call one of the telephone numbers in your block of DID numbers. If a busy signal sounds immediately, the service has probably been disconnected by the telco.

btdriver Conditions

SYMPTOM(S): LEDs do not flash on power up.

Probable Cause: There was a self-test failure at power on. The power supply requirements may be unsuitable.

Solution: Try installing the board in a different slot.

SYMPTOM(S): *btdriver* displays `No BRI TR114s Found`

Probable Cause: This message is informational. It means that you do not have a TR114 BRI ISDN board in your system. No action is required.

SYMPTOM(S): *btdriver* displays `no fax or voice boards found.`

Probable Cause: The system cannot find any boards. *Btdriver* may not detect all the channels on a board.

Solution: Put the TR114 in a different slot. Make sure that all the channel LEDs of the board flash once at power up.

Make sure that the I/O address switches on the board match the settings in the *btdriver.cnf* file.

SYMPTOM(S): *btdriver* does not detect all the channels in the system; or

btdriver detects no fax or voice boards.

Two channels should be detected for each two-channel board and four channels for each four-channel board.

Probable Cause: I/O address conflict with other devices in the system, possibly other Brooktrout boards; or

The I/O address switches do not match the settings in *btdriver.cnf*.

Solution: Ensure the `addrs` entries in the *btdriver* configuration files match the switch settings of the hardware.

Use operating system tools (such as NT Diagnostics), system documentation, or BIOS configuration, to check for device conflicts and available I/O addresses.

Remove all Brooktrout boards from the system, then re-install and test them one at a time.

Remove other boards, such as network adapters, to check for conflicts.

SYMPTOM(S): *btdriver* displays `Cannot set BFAX_INFO env var. X bytes needed, only found Y. Aborting.`

Probable Cause: The driver required more temporary environment space for the BFAX_INFO variable than was available.

Solution: The environment is limited in space. Different DOS versions use different amounts of default environment space. Change the environment space to a larger setting by putting a `SHELL` directive in your *CONFIG.SYS* file. This directive is used to specify a different command interpreter. The default is *\COMMAND.COM*. To change the environment space setting, insert the following line into *CONFIG.SYS* for DOS versions earlier than 5.0:

```
SHELL=C:\COMMAND.COM /P /E:2048
```

or for DOS 5.0 and later:

```
SHELL=C:\COMMAND.COM C:\ /P /E:2048
```

The number 2048 seems to work best in every case. After editing *CONFIG.SYS*, reboot and try again.

SYMPTOM(S): *btdriver* loads successfully but the *faxtest* program does not display output after attempting to reset the channel.

Probable Cause: Interrupt jumper wire installed on wrong number, not set snugly on the pins, or not set correctly in the *btdriver.cnf* file.

Solution: Make sure the interrupt jumper wire is on the correct pins.

Check that the interrupt pull-up switch (switch 1 on SW1) is set to ON for *only one* board in the system.

Ensure that the `intnum` parameter in the *btdriver.cnf* file matches that of the board.

Use operating system tools (such as NT Diagnostics), system documentation, or BIOS configuration, to check for device conflicts and available interrupts.

Try other interrupt settings, even if the interrupt chosen is expected to be free.

Check the BIOS configuration if one is available for your system. Many EISA systems will not allow the interrupt to be used unless it is configured in the BIOS.

Remove other boards, such as network adapters, to check for conflicts.

Sending Test Results to a File

If you cannot correct the problems you encountered, run the *faxtest* program and redirect the output to a file. Brooktrout Technical Support or the reseller from whom you purchased your TR114 board will want to examine the diagnostic test results to determine the cause of the malfunction.

In the following steps, **#** is the number of the channel you are testing, and **log** is the name of the output file. The option, **-v**, specifies verbose mode; you must include this option to collect the trace data.

1. On sending a fax, to redirect the output from the *faxtest* program to a file, type:

   ```
   faxtest -u # -v -s wphonenum >log
   ```

2. On receiving a fax, to redirect the output from the *faxtest* program to a file, type:

   ```
   faxtest -u # -v -r >log
   ```

If the program fails to exit on its own, press **Q** to quit.

We recommend that you fax or e-mail the test results to Brooktrout Technical Support or to the reseller from whom you purchased your TR114 board. For instructions on how to contact or send test results to Brooktrout Technical Support, see *Chapter 4, Contacting Technical Support*.

Rebooting under Preferred Operating System

Reboot your system to run under the operating system you normally use. If your system normally runs under DOS, and you booted your system with a special *autoexec.bat* file to run the test software, reboot your system now using the original *autoexec.bat* file that contains the lines that run your fax application software.

Configuring Your LAN Fax Software

See your LAN fax application's user manual for instructions on configuring your LAN fax software. After you have set up your LAN fax software to support the TR114, you can begin sending and receiving faxes using that software.

Chapter 4
Contacting Technical Support

Brooktrout provides technical support for customers who have purchased their TR114 board directly from Brooktrout Technology, Inc. If you purchased your TR114 board from a reseller, contact that reseller for technical support.

In the event of equipment malfunction, Brooktrout Technology, Inc. or an authorized agent should perform all repairs. The user is responsible for reporting the need for service to Brooktrout or to one of its authorized agents.

Getting Technical Support

If you call Brooktrout Technical Support, please be prepared to work with the support personnel. You may be asked to do several things, such as taking down your server.

Please have the following information ready:

- The part number (PN) of the TR114 board in question.

  Part numbers begin with the digits 802 or 812. The part number is on the back of the base board.

- Test results obtained from running the diagnostic software (refer to *Sending Test Results to a File* on page 3-20 for instructions for creating a file).

Contact the Brooktrout office nearest to you. The numbers are shown in the following pages.

Contacting Support

- Email:

U.S.:	`techsupport@brooktrout.com`
Europe:	`eurosupport@brooktrout.com`
Japan:	`inu@dns1.infocom.co.jp`
Singapore:	`singsupport@brooktrout.com`

- Telephone:

U.S.:	+1-781-433-9600 (8:30am to 8:30pm EST)
Europe:	+32-2-658-0170
Japan:	+81-3-5800-9102
Singapore:	+65-224-4485

- Fax U.S.: 781-449-9009
- FTP Site: `ftp.brooktrout.com`
- Web Site: `http://www.brktech.com`

Downloading Software from the FTP Site

You can download copies of the latest TR114 test software from the Brooktrout FTP site. Use the following procedures:

1. Connect to the Brooktrout FTP site by typing the following:

   `ftp.brooktrout.com`

2. Log in as **anonymous**. Enter your email address as your password when required.
3. Select the *support* directory.

   `cd support`

4. Select *diag.zip* and download it to your computer.
5. Unzip this file to obtain the test files.

Returning a Defective TR114 Board

If you suspect that your TR114 board is malfunctioning, contact Brooktrout Technology or the reseller from whom you purchased it.

Typically, Brooktrout Technical Support or your reseller will request that you run diagnostics on the TR114 board to determine whether it has a hardware defect. (See page 3-20 for running diagnostics and creating a file from your test output.) If it does, you will need to return the board for repair to Brooktrout Technology, Inc. or to the reseller from whom you purchased it.

If you purchased the TR114 board directly from Brooktrout Technology, Brooktrout Technology will issue a Return Material Authorization (RMA) number for it. If your TR114 board is no longer under warranty, you must get a Purchase Order Number before Brooktrout Technology will issue you an RMA number.

When returning a product on RMA to Brooktrout Technology, Inc., write the RMA number clearly on the shipping container and send the container to the following address:

Brooktrout Technology, Inc.
152 Second Avenue
Needham, MA 02494-2809

Appendix A
Common System Resource Assignments

This appendix describes the:

- Addresses used by Other Devices
- Hardware Interrupts used by Other Functions
- DMA Channels used by Other Functions

Addresses Used by Other Devices

In addition to the TR114, other boards, hardware devices, and software commonly use particular addresses. Table A-1 lists some of the functions that systems may assign to particular addresses.

Table A-1. System Address Assignments

Address	Function
000-01F	DMA controller 1
020-03F	Interrupt controller 1
040-05F	Timer
060-06F	Keyboard controller
070-07F	Real time clock
080-09F	DMA page memory
0A0-0BF	Interrupt controller 2
0C0-0DF	DMA controller 2
0E8	Shadow RAM and cache control bit
0F0-0F1	Numeric processor extension

Table A-1. System Address Assignments (continued)

Address	Function
0F8-0FF	Numeric processor extension
1F0-1F8	Fixed disk
200-207	Game I/O
278-27F	Parallel printer port 2
2F8-2FF	Serial port 2
300-31F	Prototype board
360-36F	Reserved
378-37F	Parallel printer port 1
380-38F	SDLC, bisynchronous 2
3A0-3AF	Bisynchronous 1
3B0-3BF	Monochrome display and printer adapter
3C0-3CF	Reserved
3D0-3DF	Color/graphics monitor adapter
3F0-3F7	Diskette controller
3F8-3FF	Serial port 1

Hardware Interrupts Used by Other Functions

Table A-2 lists some of the functions that computers sometimes assign to particular interrupts.

Table A-2. Hardware Interrupt Assignments

Interrupt	Function
3	Serial port 2
4	Serial port 1
5	Sound card, parallel port 2
6	Diskette controller
7	Parallel port 1
9	Software redirect to interrupt 2
10	Unassigned
11	Unassigned
12	Unassigned
14	Fixed disk controller
15	Unassigned

DMA Channels Used by Other Functions

Table A-3 lists some of the functions that systems commonly assign to DMA channels.

Table A-3. System DMA Channel Assignments

DMA Channel	Function
0	Unassigned
1	SDLC
2	Diskette (IBM PC)
3	Unassigned
4	Cascade for CTRL 1
5	Unassigned
6	Unassigned
7	Unassigned

Appendix B
Telephone Service Options

This appendix describes:

- Loop-start telephone service and what you need to order
- DID telephone service and what you need to order

Loop-Start Telephone Service

Loop-start telephone service is the same service the telephone company installs in residences. One loop-start telephone line connects one telephone number to the local telephone company's central office or to a remote switching system.

Ordering Loop-Start Telephone Service

For simple loop-start service, you must obtain the following from the telephone company:

- One loop-start telephone line for each TR114 loop-start interface (channel).

  An I2L supports up to two loop-start lines; an I4L supports up to four. An I2C supports one loop-start line; an I4C supports up to two loop-start lines.

- One USOC-RJ-11C wall jack for each telephone line.

  Make sure the telephone number or extension number is clearly marked on the cover of each jack.

For PBX or Key telephone systems, you must obtain the following from the PBX administrator:

- An analog single-line extension for each loop-start interface. An analog single-line extension provides service compatible with telephone company loop-start trunks.

Note: If you use a telephone system extension, make sure it is an analog single-line extension, not a digital extension.

- A telephone system feature, such as DIL (Direct Inward Line termination), to provide outside callers direct access to the TR114 extension.
- One USOC-RJ-11C wall jack for each telephone line.

DID Telephone Service

DID (Direct Inward Dialing) lines support incoming calls only. More than one telephone number is assigned to a pair of wires. DID analog service can enable automatic routing of facsimiles to the proper destination within a multiuser fax system.

For example, Company ABC is assigned one DID trunk that is composed of one hundred telephone numbers ranging from 239-9400 to 239-9499. When any one of the numbers in this range is dialed, the telephone company seizes the trunk and transmits the last few digits (usually 3 or 4) of the dialed number to the TR114. By detecting these digits, the TR114 can tell which of the hundred numbers was actually dialed.

If the trunk is busy, callers to any of the other numbers encounter a busy signal. Because of this situation, many fax messaging systems require more than one DID trunk to which the range of DID telephone numbers is assigned. The number of trunks required depends on the traffic demands on the system.

Since DID trunks are one-way (inward), a two-way fax messaging system using DID requires one or more loop-start telephone interfaces for sending facsimiles.

DID Operation

When a person or a fax machine dials a number connected to a TR114 DID channel, the telephone company (telco) seizes that number's line, causing loop current to flow through the board. The board detects the loop current and recognizes it as an incoming call. The next step depends on how the DID line has been configured – with wink-start (the most common configuration) service, or with immediate-start service.

On a line configured for *wink-start* service, the board performs a "wink" after it detects seizure of the line; that is, it momentarily reverses the voltage polarity applied across the phone line (i.e., tip and ring), signaling the telco that it is ready to receive the last few digits of the dialed number. The telco transmits these digits to the board with DTMF signals (or in some cases with pulse signals). You must inform the telco of the number of DID digits you want the them to transmit.

When the TR114 board has detected all of the DID digits, it reverses the polarity across the phone line again, signaling the telco that it has accepted the call. If the board does not detect the correct number of DID digits, it plays a fast busy signal.

On a line configured for *immediate-start* service, the board does not perform a wink. Instead, the telco waits a fixed amount of time after seizing the line before it sends the DID digits to the board. Then, when it detects or fails to detect the correct number of DID digits, the board responds the same as it does when configured for wink-start service.

DID Answer Supervision Signaling

In compliance with FCC DID registration, Brooktrout includes the following information regarding TR114 models I2C, I2D, I4C and I4D for the customer:

1. Allowing this equipment to be operated in such a manner as to not provide proper answer supervision signaling is in violation of FCC Rules, Part 68.
2. This equipment returns answer supervision signals to the PSTN when 1) Answered by the called station, 2) Answered by the attendant, 3) Routed to a recorded announcement that can be administered by the CPE user, and 4) Routed to a dial prompt.
3. This equipment returns answer supervision on all DID calls forwarded back to the PSTN. Permissible exceptions are: 1) A call is unanswered, 2) A busy tone is received, or 3) A recorder tone is received.

Ordering DID Telephone Service

The following specifications are for direct connection using a wall jack. If you will be connecting through a PBX, check with your PBX support person to see if your PBX supports DID service.

For DID service, you must obtain the following from the telephone company:

- One DID telephone trunk for each TR114 DID interface.
- A block of telephone numbers (usually 100 or 1000 numbers per block) associated with the trunk.

For DID telephone service, a power supply must be installed and running on the TR114 before the telephone company can activate a DID line. Once the DID line is activated, -48V$_{DC}$ power must be continuous, or the telephone company may disconnect the DID service.

You must provide the telco with a specification of the DID service options you want.

DID Service Options

Before you order DID service from your telephone company, you need to find out what DID service options are available in your area and decide which options you want. These service options define how your DID service will operate.

DID service options include:

Service type	-	**Wink Start/**Immediate Start
Signaling type	-	**DTMF (Touch-Tone)**/Pulse
Number of digits	-	Three/**Four**
Trunk Type	-	**Loop start (2-wire)**

Brooktrout recommends the options listed in **bold** type.

Note: After you know what service options you will have, you must specify the service type and number of digits in your software configuration file (in the Brooktrout API 4.0, it is the *btcall.cfg* file).

Service Type

The TR114 supports both wink-start and immediate-start service. Brooktrout recommends wink-start service because it is faster and less prone to errors than immediate-start service. The following table describes the difference between wink-start and immediate-start service.

Service Type	Interdigit Delay Time
Wink-Start	The TR114 expects to see the first DID digit within 5 seconds after the telephone is activated. Each successive digit must arrive within 5 seconds of the previous one.
Immediate-Start	The TR114 expects to receive the first DID digit within 18 seconds after the telephone is activated. The maximum interdigit delay is 18 seconds. This service type may be easier to use for hand-dialed testing.

If immediate-start is the only service available from your telephone company, consult the documentation supplied with your software for information on how to support it.

Signaling Type

The signaling type can be pulse or DTMF (touch-tone).

- Pulse signals are those generated by rotary-dial telephones.
- DTMF tones are those generated by touch-tone telephones.

The TR114 generates and detects DTMF and pulse signals automatically, so you do not specify them through software.

Number of Digits

DID analog service sends the last few digits of the dialed telephone number to the TR114 as a routing address. You must specify the number of DID digits the TR114 expects to receive to the telephone company and in the software.

Trunk Type

The trunk type options are loop-start 2-wire DID and ground-start DID. Brooktrout supports 2-wire loop-start DID only.

Appendix C
Telephone Jack Pinout

Brooktrout provides pinout information for users who may want to make their own telephone cords and who may want to access only one or two channels on the four-channel TR114 or only one channel on two-channel boards.

The cable included with the board connects the channels to single-pair wiring. Two-channel boards are supplied with a two-split cable; four-channel boards are supplied with 2 two-split cables.

The two-channel TR114 ISA analog boards have one RJ-45 telephone plug (PJ1). Four-channel boards have two RJ-45 telephone plugs (PJ1 and PJ2). PJ1 accesses channels 0 and 1, and PJ2 accesses channels 2 and 3.

The pinout for the RJ-45 jack is as follows (pin 1 is closest to the ISA bus connector - refer to Figure 2-3 for the location)

Table C-1. Telephone Jack Pinout

RJ-45 Pin Number	PJ1 Signal	TR114 Channel		PJ2 Signal	TR114 Channel
8	NC	--		NC	--
7	NC	--		NC	--
6	Ring 1	1		Ring 3	3
5	Tip 0	0		Tip 2	2
4	Ring 0	0		Ring 2	2
3	Tip 1	1		Tip 3	3
2	NC	--		NC	--
1	NC	--		NC	--

Appendix D
North American Standards Compliance

Note to developers, system integrators, value added resellers and distributors:
The following compliance information must be provided to your customer and the end user as part of your system documentation.

In the United States, the Federal Communications Commission (FCC) and in Canada, Industry Canada (IC), regulate all electronic devices that connect to the telephone system and/or generate radio frequency signals. The TR114 is such a device and must comply with the regulations specified below.

Telephony Regulations

FCC Regulations Regarding Connection to the Phone Line (Part 68):

The Federal Communications Commission (FCC) has established rules which permit the TR114 to be directly connected to the telephone network.

- Jacks used in the premises wiring for connection to the telephone network must comply with FCC Rules, Part 68. Please refer to information below for the correct jack to use for each service. An FCC-compliant modular cable with compliant plugs on each end is supplied to interconnect the board and the premises wiring or telephone network.
- This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs. (Contact your state public utility commission or corporation commission for information.)

A malfunctioning circuit can harm the telephone network. Disconnect a malfunctioning TR114 board from the telephone network until you determine the cause of the malfunction and repair it. If a malfunctioning TR114 remains connected, the telephone company may temporarily disconnect service.

The telephone company may make changes in its technical operations and procedures. If such changes can affect compatibility with the TR114, the telephone company must give adequate notice of the changes.

The telephone company may request information on equipment connected to its lines. Give its representative the following information:

- The telephone number(s) to which the TR114 is connected
- The FCC registration number. See back of board

For Loop-Start boards:

- The ringer equivalence number (REN) See back of board
- The type of wall jack required USOC-RJ-11C
- The facility interface code 02L52

For DID boards:

- The service order code. 9.0F
- The type of wall jack required USOC-RJ-11C
- The facility interface code 02RV2-T

The ringer equivalence number (REN) determines how many devices can be connected to your telephone line. In most areas, the sum of the RENs of all the devices on any line should not exceed 5. If too many devices are attached, they may not ring properly. REN does not apply to DID or digital lines.

When assembling a system, the registration numbers of all devices must be listed on the exterior of the final assembly for easy access.

FCC Rules Regarding Fax Branding

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone fax machine, unless such message clearly contains, in a margin at the top or bottom of each transmitted page, or on the first page of the transmission, the date and time the message is sent and an identification of the business, other entity, or other individual sending the message and the telephone number of the sending machine or such business, other entity, or other individual.

Users:

To program this information into your fax machine, complete the procedure described in your user's manual.

Developers:

You must include facilities in your application to enable the user to enter the required information. Use the **BfvFaxHeader** function to place this information on the transmitted page(s) as required. You must also include in your user's manual instructions for entering this information into your system.

IC Equipment Attachment Limitations (CS-03)

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas. Users should not attempt to make installation connections themselves, but should contact the appropriate electric inspection authority or electrician, as appropriate.

The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

The Industry Canada certification number is found on the back of the board.

Electromagnetic Emissions

This product was tested for emissions in a personal computer meeting the limits of FCC Rules, Part 15 Class B. In order to ensure that it continues to meet the Class A emissions limits, it should be installed in a host computer or other enclosure which also meets the Class B limits and bears an FCC Rules, Part 15 registration number, an FCC logo and/or a CE marking.

FCC Emissions Information

All computing devices utilizing clock frequencies in excess of 10 kHz must be tested for compliance with RF emission limits set by the FCC.

The TR114 has been tested as a Class A computing device.

Changes or modifications to this unit not expressly approved by Brooktrout Technology, Inc. could void the user's authority to operate the equipment.

Pursuant to Part 15 of the FCC Rules, this equipment has been tested and found to comply with the limits for a Class A digital device. These limits provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at his or her own expense.

IC Emissions Notice

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la class A est conforme à la norme NMB-003 du Canada.

Safety

The TR114 is recognized by ETL; the component recognition number is on the back of the board. The TR114 has been tested and complies with UL Standard 1950, 3rd ed./ CSA C22.2 No. 950-95, 3rd ed. "Safety of Information Technology Equipment, Including Electrical Business Equipment."

This product must be mounted in the final assembly so that it is isolated from exposure to any hazardous voltages (voltages greater than 42.4V peak or 60Vdc) within the assembly. Adequate separation and restraint of cables and cords must be provided.

To maintain the safety certification of the system, ensure that the power drawn from the power supply does not exceed its capacity. Please refer to the power usage table elsewhere in this manual for information on the voltages and currents required for proper operation.

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